

**Progress Report to OGP****“Assessing and accounting for Model Related Errors in climate Forecasting”****(GAPP project GC02-228)****Principal Investigator: Zoltan Toth, EMC/NCEP****Summary of tasks completed in 2004:**

Evaluation of ensembles with various cumulus parameterization schemes (CPS) and multi-model-version ensembles of similar size shows that a statistical bias-correction procedure may improve the ensemble mean forecasts and ensemble-based probabilistic forecasts (Fig.1). On the other hand, no significant improvement is achieved in the ensemble forecast of precipitation and atmospheric variables by including model diversity in terms of CPS. Further analysis shows that change in model CPS may lead to some random variation in climate forecast but no systematic variation. Preliminary experiments with various formulations of stochastic physics suggest that including stochastic physics in the model is a promising approach in improving the characteristics of ensemble forecasts.

**Contributions to GAPP synthesis products:**

The improvement in global ensemble forecasts through statistical bias correction suggests that post-processing procedures should be applied to the model output of climate prediction before incorporating them into operational hydrological forecasts. While stochastic physics is promising in improving ensemble weather forecasting, the lack of sensitivity in ensemble forecasts to the inclusion of multi-cumulus parameterization schemes indicates that land and ocean states, including soil moisture, snow cover, orography and vegetation, as well as SST, may be major sources of model-related uncertainty and should be considered in ensemble climate prediction.

Fig.1. ROC area of probabilistic forecast based on SAS (red), bias corrected SAS (green) and a dual version (SAS and RAS, bias corrected) ensemble SRSRS (black) for 500hPa height over northern hemisphere (upper panel) and 850hPa temperature over the tropics (lower panel). It can be seen that ensemble based probabilistic forecast can be improved (ROC area increased) by bias correction (compare red and green), but not by using multi-model version ensembles (compare green and black).

